GALKINA, Z.P.; SHEVCHIK, V.N., rabochiy

Letters to the editor. Zashch. rast. ot vred. i bol. 8 no.6:12 Je '63. (MIRA 16:8)

1. Nachal'nik Volgogradskoy karantinnoy inspektsii (for Galkina).
2. Uchebnoye khozyaystvo Leningradskogo sel'skokhozyaystvennogo instituta. obshchestvennyy inspektor Vserossiyskogo obchestva okhrany prirody (Pushkin, Leningradskoy oblasti) (for Shevshik.
(Plant Protection of

PA 150T71

USSR/Physics - Klystron Nov 49

"On the Theory of the Klystron," V. N. Shevchik; Phys Inst, Saratov, 5 pp

"Zhur Tekh Fiz" Vol XIX, No 11

It is usually considered that the transit time of an electron through the buncher part of the resonator which is velocity-modulating the electron stream may be disregarded. This assumption loses its validity as frequency and distance between buncher grids are increased. Calculates effect of changing size of drift space as a function of the transit angle of electrons through the buncher. Problem has been solved

USSR/Physics - Klystron (Contd) 150T71 Nov 49

graphically by Phillips and Ware, but analytical solution yields more general results. Submitted 19 Jul 48.

150T71

SHEVCHIK, V. N.

SHEVCHIK, V.

Electrical Engineering Abst.
Vol. 57 No. 675
Mar. 1954
Telecommunication

621.396.61

1263. Broadcasting transmitters of very high power. V. Ševčík. *Slaboproudý Obzor*, 14, No. 5, 206-13 (1953) *In Czech.*

A modern Czechoslovak transmitter is described, consisting of two identical 200 kW units capable of working independently or in parallel, giving a total power of 400 kW. The master oscillator is thermostatically controlled and employs either a crystal or an LC circuit. When working in parallel the two h.f. output stages are driven by one h.f. unit, the phase difference between the two carriers being thereby reduced. The l.f. part (modulator) contains a limiter which protects the transmitter against overmodulation. The last l.f. stage, which works as a class B push-pull amplifier, is driven by a cathode follower. All the valves are a.c. heated. The main supply delivers 330 to 600 kW at 15 kV. Schematics and photographs of various parts of the transmitter are given. R. S. SIDOROWICZ

Shevchik, V.N.

FD-3185

USSR/Physics - Magnetron Theory

Card 1/1 Pub. 153-15/21

Author : Shevchik, V. N.

Title : Cascade grouping of electrons in application to the theory of the multiresonator magnetron

Periodical: Zhur. tekh. fiz., 25, No 8 (August), 1955, 1462-1470

Abstract : The author states that in earlier works on this subject the methods of calculation adopted by the authors yielded only the boundaries of the self-excitation regions of a generator, and in addition only theoretical magnetrons with infinitely thin cathodes were considered, making the complete application of these results to magnetron construction impossible. In this article the author considers a magnetron with "thick" cathode. He analyzes forms of oscillations different from the pi-form, finds self-excitation and stationary oscillation conditions, and derives an expression for complex electronic conductivity.

Submitted : February 25, 1954

SOV/112-59-1-1555

9(4)

Translation from: Referativnyy zhurnal. Elektrotekhnika, 1959, Nr 1, p 218 (USSR)

AUTHOR: Shevchik, V. N.

TITLE: On the Theory of Reflex Klystron

PERIODICAL: Uch. zap. Saratovsk. un-t, 1956, Vol 44, pp 167-177

ABSTRACT: The process of phase focusing in a reflex klystron with a finite transit time of electrons in the cavity is considered. In actual tubes, this time is within 1/4 - 1/2 m, where m is the period of oscillations. The moment t_1 of electron arrival in the cavity is selected as an independent variable for transit angles and electron velocities. With the transit angle $2\pi < \varphi_0 \leq 3\pi$, the electron stream can yield high-frequency energy during both the first and second passage through the cavity. Electron foci are formed in the process of electron movement in a retarding field. The electrons arrive in the modulator during reverse motion of the stream in the retarding field as determined by this expression

Card 1/2

SOV/112-59-1-1555

On the Theory of Reflex Klystron

$$\sin(\alpha + \frac{\varphi_0}{2}) = 0 \qquad \left| 0 \leqslant \alpha \leqslant 2\pi \right|$$

The expression determines the phase of the second arrival of the central bunch electron in the modulator. If the H-F field is retarding for the given focus and if the field strength is at its maximum, conditions of reflex-klystron self-excitation are brought about. One of the most interesting cases of self-excitation occurs at a great transit angle, about 3π. Here, the greater the transit angle, the greater value of $\varepsilon = U_1/U_0$ is needed to maintain oscillations. This does not increase the losses, however, because the modulation does not require any power at such φ_0. Such a klystron is interesting for the short-wave subband of the centimeter band, because the realization of small φ_0 at high frequencies meets with great engineering difficulties. The klystron can operate either with maximum accelerating voltage U_0 or with considerable separations between the cavity grids that are required for large transit angles.

A.G.P.

Card 2/2

109-2-1-13/17

AUTHOR: Shevchik, V. N.

TITLE: Analysis of the Energy Exchange Between an Electron Stream and an Electromagnetic Wave (Analiz obmena energiyey mezhdu elektronnym potokom i elektromagnitnoy volnoy)

PERIODICAL: Radiotekhnika i Elektronika, 1957, Vol 2, Nr 1, pp 104-110 (USSR)

ABSTRACT: Some problems of interaction between an electron stream and a traveling electromagnetic wave in a kinematic approximation are examined. The bunching of electrons in a traveling wave identical with the bunching in a klystron is analyzed. The maximum first-harmonic current in the traveling wave is determined. The efficiency of electronic interaction between the stream and the traveling wave is determined. The concept of synchronization is formulated accurately. The calculations are extended to the case of TW tubes and the optimum conditions of operation of a backward-wave tube at small amplitudes are found.

A mathematical analysis is offered of a practical case of interaction between an electron stream and an electromagnetic wave whose amplitude changes with

Card 1/3

109-2-1-13/17

Analysis of the Energy Exchange Between an Electron Stream (Cont.)

distance. A pattern is considered wherein an electromagnetic wave and an electron stream are moving in the same direction. The following assumptions are made: (1) the wave field is small, so that it does not materially affect the average velocity of the electron stream; (2) the straight-line electron stream is thin, so that the cross-section of the field is constant; (3) the electron-stream space charge does not materially affect the interaction. An equation for electron travel in a wave is written (formula 1) and after integration, the transit angle (formula 2) and the electron speed (formula 3) are determined. Further, the conditions of electron current bunching are analyzed (formulas 7 and 9). Electronics efficiency is determined (formula 10, figures 1-4). Investigation shows that maximum efficiency occurs in the case of a direct delayed wave. When the average velocity of the electrons is equal to the phase velocity of the wave, the energy interaction is zero. This case is important for the theory of a TW tube. Examination of the electronics efficiency curve (figure 4) as a function of the length of the interaction space permits selecting the value of current corresponding to the maximum efficiency of a TW tube or a backward-wave tube. The design formulas developed can be extended to the case of a

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109-2-1-13/17

Analysis of the Energy Exchange Between an Electron Stream (Cont.)

small-amplitude operating current and also a starting current of a backward-wave tube. The starting current value as calculated from formula 14 is in good agreement with Kompfner's and Walker's formulas (references 9 and 10). There are 4 figures and 10 references, 5 of which are Soviet, in the article.

SUBMITTED: March 14, 1956

AVAILABLE: Library of Congress

1. Electrons--Motion 2. Electromagnetic waves 3. Harmonic functions --Applications

Card 3/3

AUTHOR SHEVCHIK, V.N., STAL'MAKHOV, V.S. PA - 2579

TITLE Regarding the effect of special charge upon interaction between the electronic flow and the travelling magnetic wave. (O vliyanii prostranstvennogo zaryada na vzaimodeystviye elektronnogo potoka s begushchey elektromagnitnoy volnoy.Russian)

PERIODICAL Radiotekhnika i Elektronika, 1957, Vol 2, Nr 2, pp 230-236 (U.S.S.R.)

Received 4/1957 Reviewed 6/1957

ABSTRACT Here a further development of the kinematic analysis of energy exchange between the electronic flow and the propagated wave is concerned which had been carried out by V.N.Shevchik in his earlier works(reports 1956, 1955).The influence of the space charge field on the magnitude of electron efficiency is determined. First, the differential equation for the variable velocity component of the electrons is derived. Next, the relation for the first approximation of the relative angle of flight of the electrons in the field of the propagated wave is found. In the next chapter computation of the current grouped in the field of the propagated wave and the efficiency of electron interaction is carried out. From the equations obtained for the active and reactive components of efficiency of electronics the following important conclusion may be drawn: the interaction of the electronic flux and the propagated wave is determined by the electronic angle of flight Φ_0 with respect to the wave. This angle is

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[illegible] it can be compared with the magnitude Φ_0. (ω_e denotes the eigenfrequency of the plasma oscillations and θ denotes the parameter of the space charge). With $\theta_0 = \pm\Phi_0$ the degree of efficiency of electronics reaches its maximum value. As an addition to the analysis the computation of [illegible] relations for the generator of a reversible wave is carried out in consideration of the space charge. In conclusion the results of the analysis are compared with experimental data and with the formulae obtained by other authors. (5 ill. and 4 citations from Slav Publications)

ASSOCIATION

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SUBMITTED 4/1956

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Card 2/2

AUTHOR: SHEVCHIK, V.N., ZHARKOV, YU.D. PA - 2580

TITLE: Cascade Grouping of Electrons for Application to Analysis of Interaction between the Electronic Flow and the Travelling Electromagnetic Wave. (Kaskadnaya gruppirovka elektronov v primenenii k analizu vzaimodeystviya elektronnogo potaka s begushchey elektromagnitnoy volnoy, Russian)

PERIODICAL: Radiotekhnika i Elektronika, 1957, Vol 2, Nr 2, pp 237-243 (U.S.S.R.)
Received: 4 / 1957 Reviewed: 5 / 1957

ABSTRACT: The cascade grouping of electrons is investigated in the course of a series of high-frequency intervals. Such a scheme is best realized e.g. in MIL'MAN'S lamp, but is also characteristic of most other devices that form return waves. The current grouped in the field and the efficiency of interaction are computed and the corresponding formulae are derived. The analysis of the equations obtained shows that this is a periodic function of the angle of flight of the electrons with respect to the wave φ_0 with a period of 2π. The analysis makes it possible to obtain the fundamental relations which are used on the occasion of the electrodynamic investigated of the inhomogeneous decelerated systems and thus to give an other interpretation of space-harmonic oscillations . The

Card 1/2

AUTHOR: SHEVCHIK,V.N., SUSLOV,S.A., ZHARKOV,YU.D. PA - 2138

TITLE: On the Investigation of a Special Type of reflecting Clystron (Issledovaniya otrazhatel'nogo klistrona spetsial'nogo tipa. Russian).

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol 27, Nr 2, pp 377 - 386 (U.S.S.R.)
Received: 3 / 1957 Reviewed: 4 / 1957.

ABSTRACT: The present work deals with the theoretical and experimental investigation of a special type of reflecting clystron which works with large angles of flight in the space of interaction. First the efficiency of the clystron is dealt with. Computation of efficiency must be carried out in consideration of the modulation of current density. The general equation for active effectivity ϱ is derived. If, however, the modulation of the current according to density is neglected, a formula is in this case obtained, which is generally regarded as basic for the theory of the reflecting clystron and which, in the case of the neglect of the modulation with respect to density in the resonator, can be used for determining efficiency. For large angles of flight, i.e. if modulation according to density is considerable, the first general formula must be used. Besides the "clystron-effect", which is determined by these equations, also the so-called diode-effect must be taken into account when computing efficiency, which is connected with the output or yield of high frequency

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On the Investigation of a Special Type of reflecting Clystron.

energy on the occasion of the modulation of the electron flux according to velocity. The equations for the determination of efficiency in the case of large and small angles of flight are derived and the curves for concrete cases are shown by four diagrams. The problem of the most advantageous mode of operation of the reflecting clystron has to be solved in consideration of the value of electric torque. The electric torque may be determined from the condition of the equality of the active conductivity of the electron flux and of the resonator. The block scheme of the system with which experiments were carried out is shown and described. Experimental results showed good agreements with theoretical computations. (11 illustrations).

ASSOCIATION: State University, Saratov.
PRESENTED BY:
SUBMITTED: 9.3.1956
AVAILABLE: Library of Congress.

Card 2/2

SOV/123-59-20-83078

Translation from: Referativnyy zhurnal. Mashinostroyeniye, 1959, Nr 20, p 92 (USSR)

AUTHOR: Shevalkin, I.

TITLE: Machine Tool for Planishing Thin-Walled Machine Parts

PERIODICAL: Byul. tekhn.-ekon. inform. Sovnarkhoz Tul'sk. ekon. adm. r-na, 1958, Nrs 3 - 4, pp 50 - 51

ABSTRACT: Based on a standard machine, a special one for the planishing of thin-walled machine parts was manufactured. The machine tool has a headstock and a tailstock, a carriage, a pneumatic mechanism and a pressing device. With a pressure of 4 - 5 atm., air is pressed into the pneumatic cylinders. Rotation speed of the machine part processed amounts to 1,200 rpm, the stress on the work piece during the planishing process is 120 - 150 kg. The machine part is fixed on a mandrel which is fitted to the spindel, and is clamped by the pressure from the pneumatic cylinder. The planishing process of the machine part is taking place during the forward motion of the carriage by the pneumatic drive. A spherical plate of BR-8 alloy is soldered on the operating end of the pressing device.

M.G.N.

Card 1/1

SOV-109-3-6-23/27

AUTHOR: Shevchik, V. N.

TITLE: A Simplified Theory of the Backward-Wave Oscillator (Uproshchennaya teoriya generatora obratnoy volny)

PERIODICAL: Radiotekhnika i Elektronika, 1958, Vol 3, Nr 6, pp 847-850 (USSR)

ABSTRACT: It is assumed that the electromagnetic wave in the system propagates along the axis x and that the motion of the electrons can be described by:

$$\ddot{x} = \eta E e^{j(\omega t - \beta x)} \quad (1)$$

where $\beta = \omega / v_{\Phi}$; v_{Φ} is the phase velocity and $\eta = e/m$.

By successive integration of Eq.(1), the transit time of the electrons is shown to be in the form of Eq.(2) where l is the length of the interaction space and the parameters μ, ξ, ρ and φ_0 are expressed by Eq.(3). By solving Eq.(2)

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SOV-109-3-6-23/27

A Simplified Theory of the Backward-Wave Oscillator

with respect to φ, the transit time is given by Eq.(4). From this it is possible to derive equations for the current components in the tube and these are expressed by Eq.(9). The fundamental of the current is given by Eq.(10) and it has a maximum when $X = 1.84$, X being the bunching parameter. The average interaction power of the electron beam can be expressed by Eq.(13), where $\Phi_0 = \rho \varphi_0$. The power P_e is plotted as a function of Φ_0 in Fig.2. From Eq.(13) it is possible to determine the starting current of the tube and this is given by Eq.(17). Eq.(13) can be used to determine the efficiency of the tube and it is found that the maximum efficiency is expressed by Eq.(19), which is calculated for $\Phi_0 = -0.82\pi$. The calculated efficiency of the tube is represented by the curve in Fig.3; the curve also shows the efficiency as measured experimentally; by comparing the calculated and the experimental results, it is seen that

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A Simplified Theory of the Backward-Wave Oscillator

the agreement between the two is satisfactory. The paper contains 3 figures and 8 references; 2 of the references are Soviet, 5 English and 1 French.

SUBMITTED: January 25, 1957

1. Oscillators - Theory 2. Electromagnetic waves - Analysis 3. Electrons - Motion 4. Mathematics - Applications

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06501

SOV/141-58-4-17/26

AUTHORS: Stal'makhov, V.S., Shevchik, V.N., and Zharkov, Yu.D.

TITLE: Analysis of the Operation of the Backward-Wave Oscillator by Employing a Cosinusoidal Approximation of the Field (Analiz raboty LOV v kosinusoidal'nom priblizhenii polya)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1958, Nr 4, pp 131-136 (USSR)

ABSTRACT: The exact linear theory of backward-wave oscillators (Ref 6), which is based on the simultaneous solution of the field and electron equations, shows that the distribution of the field amplitude during the start regime of the tube can be approximately described by the cosinusoidal law (Ref 11). The longitudinal component of the high frequency electric field in the interaction space can, therefore, be written as:

$$E_1 = E_o \cos \frac{\pi z}{2L} e^{j(\omega t-\beta z)} \qquad (1)$$

where E_o is the amplitude of the field at $z = 0$, $\beta = \omega/v$ and v_f is the propagation constant.

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SOV/141-58-4-17/26

Analysis of the Operation of the Backward-Wave Oscillator by Employing a Cosinusoidal Approximation of the Field

Eq (1) can also be written as Eq (2). The electron beam has an average velocity v_o in the direction of the axis z and its average space charge density is ρ_o. The basic equations describing the electron beam can be written as

$$i = \rho v + \frac{1}{4\pi}\left[\frac{\partial E_1}{\partial t} + \frac{\partial E_2}{\partial t}\right];$$

$$\frac{\partial E_2}{\partial z} = 4\pi\rho \qquad (3)$$

$$\frac{\partial v}{\partial t} + v\frac{\partial v}{\partial z} = \frac{e}{m}\left[E_1 + E_2\right]$$

where E_2 is the field of the space charge. By employing the notation defined by Eq (4), the

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SOV/141-58-4-17/26

Analysis of the Operation of the Backward-Wave Oscillator by Employing a Cosinusoidal Approximation of the Field

alternating velocity component of the electrons can be found from Eq (5) where ω_e is the plasma frequency, ωt_1 is the input phase and φ is the absolute transit angle in the interaction space. By carrying out the double integration of Eq (5), it is shown that φ is given by Eq (6). By employing the space charge conservation law, the density of the bunched electron current is given by Eq (7). The real interaction power is, therefore, given by Eq (8) where $\Phi_o = \varphi_o(1-v_o/v_\Phi)$ is the so-called relative transit angle for the interaction space, $\xi = E_oL/V_o$ and $\Theta_o = \omega_e L/v_o$. The variations of the real power P_{ea} are plotted in Fig 1 as a function of Φ_o. The function Φ_o is plotted in Fig 2 against Θ_o. The above analysis permits the evaluation of the starting current for the oscillator tube. This current is expressed by:

$$I_{st} = \frac{8V_o}{Z_o(2\pi N)^3} F(\Theta_o) \qquad (9)$$

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06501

Analysis of the Operation of the Backward-Wave Oscillator by Employing a Cosinusoidal Approximation of the Field

SOV/141-58-4-17/26

where $F(\Theta_o)$ is a function reciprocal to Eq (8). The start-current characteristic of the system can also be written as Eq (10), where $C^3 = Z_o/4V_o$ and $N = L/\lambda$. Eq (10) is plotted in Fig 3 (the solid curve); the dashed curve in Fig 3 was evaluated by using the formula from Ref 3. It is seen that the results obtained by either formula do not diverge appreciably. The results obtained from Eq (10) are also compared with values obtained by Johnson (see Fig 4) and by Walker (see Fig 5); the works of Johnson and Walker are mentioned in Ref 7 and 9 respectively. There are 5 figures and 13 references, 9 of which are Soviet and 4 English.

ASSOCIATION: Saratovskiy gosudarstvennyy universitet (Saratov State University)

SUBMITTED: 8th January 1958

Card 4/4

9(3,4) PHASE I BOOK EXPLOITATION SOV/1999

Shevchik, Vladimir Nikolayevich

Osnovy elektroniki sverkhvysokikh chastot (Principles of Superhigh Frequency Electronics) Moscow, Izd-vo "Sovetskoye radio," 1959. 306 p. Errata slip inserted. No. of copies printed not given.

Ed. (Title page): A.I. Kostiyenko; Ed. (inside book): V.G. Masharova; Tech. Ed.: B.V.Smurov.

PURPOSE: The book may be used by radio engineers and senior students of higher specialized schools.

COVERAGE: The author presents the fundamentals of superhigh-frequency electronics. He discusses the theory of modern superhigh-frequency devices and presents their basic experimental characteristics. The material is based on lectures delivered by the author at the radio physics department of Saratov State University. No personalities are mentioned. There are 119 references: 47 Soviet (including 5 translations), 42 English, 19 French and 11 German.

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TABLE OF CONTENTS:

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Principles of Superhigh Frequency (Cont.) SOV/1999

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A001/A001

Translation from: Referativnyy zhurnal, Fizika, 1960, No. 10, p. 309, # 27426

AUTHORS: Shevchik, V.N., Zharkov, Yu.D.

TITLE: Cascade Grouping of Electrons as Applied to Analysis of "Karsinotron"

PERIODICAL: Tr. Konferentsii po elektronike SVCh, 1957, Moscow-Leningrad, Gosenergoizdat, 1959, pp. 226 - 235

TEXT: Interaction of an electron beam with the field of a non-homogeneous decelerating system is considered as interaction with the fields of successive hf-gaps (slots) separated by regions of drift free of hf fields. In distinction from the method of space harmonics, such an approach reflects better the actual physical nature of the phenomenon and makes it possible to account for the effect of harmonics, asynchronous with the beam, on energy transfer. Expressions for the real and reactive powers of interaction are derived. The transfer of energy to the field is possible at certain relations between the phase velocity of the hf-wave in the slots and the electron speed when the electrons, passing one gap after another, get into the same phase of the hf-field. This corresponds to interaction

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A001/A001

Cascade Grouping of Electrons as Applied to Analysis of "Karsinotron"

of the electron beam with one or another harmonic when using the electro-dynamic approach. The effect of asynchronous space harmonics on the interaction power is the greater, the less is the number of hf-gaps; at a number of slots > 40-50, it can be neglected. A formula for the starting current of the ЛОВ (LOV)-generator (backward-wave tube) has been derived and compared with an analogous formula which was obtained on the assumption that only interaction with a single space harmonic is essential.

G.N. Shvedov

Translator's note: This is the full translation of the original Russian abstract.

Card 2/2

05208
SOV/142-2-3-16/27

9(2,9)

AUTHOR: Shevchik, V.N., Mayofis, L.Ya.

TITLE: Characteristic Equations for Travelling Wave Tubes and Backward-Wave Oscillators With Discrete Interaction of Electrons With an Electromagnetic Wave

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiotekhnika, 1959, Vol 2, Nr 3, pp 367-371 (USSR)

ABSTRACT: In this article a linear analysis of a travelling wave tube and a backward-wave oscillator is given, based on the fact of discrete interaction of the electrons with the (self-matched) electromagnetic field which is formed by them. The linear theories of the travelling wave tube and the backward-wave oscillator found widespread application. They are based on the assumption of the continuous interaction of the electron flow with the travelling electromagnetic wave. In the past, however, the application of filter-type periodic structures as delay lines required the consideration of the discrete character of the electron interaction with the periodically localized electromagnetic field. In certain approximations, the assumption of such a field as an infinite sum of spa-

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Card 2/3

...y field
...nonuniform
...substitute cir-
...ected sections of a
...electromagnetic wave are in-
...ors derive the characteristic equa-
... $p+j\theta_o-1)^2=\pm 2jC^3 M^2 \theta_o \mathrm{sh}\, \Gamma$ ... $p+j\theta_o$
...gation constant; M... effective interaction factor;

9(3)

SOV/142-2-5-1/19

AUTHOR: Shevchik, V.N., Shvedov, G.N.

TITLE: Space Charge Waves in Electron Stream - A Review

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiotekhnika, 1959, Vol 2, Nr 5, pp 511 - 553 (USSR)

ABSTRACT: This is a systematic review of papers dealing with space charge waves in electron guns. Thusfar, these papers have been systematized to an inadequate extent. The systematic discussion of electron-wave processes in different electron streams is limited to such systems in which electron-wave processes are of utmost importance. Systems similar to traveling wave tubes were not taken into consideration, since here electron-wave processes are only corrections of the basic electromagnetic phenomena proceeding in external oscillatory circuits. The mathematical analysis was based on books by V.M. Lopukhin [Ref 3] and S.D. Gvozdover [Ref 4]. Discussing Brillouin streams, the authors

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SOV/142-2-5-1/19

Space Charge Waves in Electron Stream - A Review

mention papers by numerous foreign scientists and the Soviet scientists M.M. Bredov /Ref 34/, M.D. Gabovich /Ref 36/, V.I. Volosok, V.B. Chirikov /Ref 37/ and Yu. A. Katsman, /Ref 39/. The papers of V.M. Lopukhin /Ref 53/, A.A. Vlasov /Ref 54,55/, S.K. Lesota /Ref 62/, M. I. Rodak /Ref 63/ Yu.K. Bergner /Ref 64/, Z.S. Chernov /Ref 64/, are mentioned in connection with electron streams with discrete velocity distributions. L.D. Landau's /Ref 70/ and A.A. Nikolayev's papers deal with electron flows with continuous distribution of velocities. Electron streams with a periodic structure were discussed in papers by P.C. Bliokh, Ya.B. Fayn-berg /Ref 86/, V.A. Solntsev, A.S. Tager /Ref 91/, P. V. Bliokh /Ref 92/, G.A. Bernashevskiy /Ref 93/, V.I. Mnoyan, D.K. Akulina /Ref 94/, S.I. Tetel'baum /Ref 102-105/ and P.A. Borodovskiy /Ref 109/, A.S. Tager's paper /Ref 115/ is mentioned in connection with space charge noise waves. The publication of this paper

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SOV/142-2-5-1/19

Space Charge Waves in Electron Stream - A Review

was recommended by the Kafedra elektroniki (Electronics Department) of the Saratovskiy gosudarstvennyy universitet imeni N.G. Chernyshevskogo (Saratov State University imeni N.G. Chernyshevskiy). There are 18 graphs, 4 sets of graphs, 2 diagrams and 143 references, of which 83 are English, 32 Soviet, 22 German and 6 French.

SUBMITTED: December 22, 1958

Card 3/3

SOV/109-4-1-18/30

AUTHORS: Shevchik, V.N. and Oleynikova, I.P.

TITLE: Interaction Between a Modulated Electron Beam and a Travelling Electromagnetic Wave (Vzaimodeystviye modulirovannogo elektronnogo potoka s begushchey elektromagnitnoy volnoy)

PERIODICAL: Radiotekhnika i Elektronika, 1959, Vol 4, Nr 1, pp 128 - 130 (USSR)

ABSTRACT: The following system is considered (see the figure on p 128). An electron beam which is modulated in the Region I by the field of a travelling wave, enters the drift Region II, where additional bunching of the electrons takes place; subsequently, the beam enters the interaction Region III, where a slow wave is propagated. If the signal is small, the velocity v_1 and the relative transit angle Φ_1 in the Region I are expressed by Eqs (1) and (2), while the modulation of the transit angle θ in the Region II is given by Eq (3). The velocity of electrons in the Region III is given by Eq (4), while the relative transit angle Φ_2

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Interaction Between a Modulated Electron Beam and a Travelling Electromagnetic Wave

in the region is expressed by Eq (5). Consequently, the bunched current in the Region III is expressed by Eq (6). The power of the interaction of the electron beam and the wave field is expressed by Eq (7) which, by employing the alternating component of the current from Eq (6), can be written in the form of Eq (8). From Eq (8) it follows that the energy exchange between electrons and the field of the travelling wave is described by four partial effects. The first term of Eq (8) is due to the so-called "klystron effect". The second term is due to that portion of the variable current component which is produced as a result of the electron bunching in the Region III; this in turn is due to the velocity modulation performed in the Region I. The third term describes the interaction between the wave in the Region III and the direct component of the current. Finally, the fourth term characterises the power produced in the Region III by that portion of the variable current

SOV/109-4-1-18/30

Interaction Between a Modulated Electron Beam and a Travelling Electromagnetic Wave

component which is produced as the result of the bunching of the electrons in the Region I.
There are 1 figure and 11 references, 9 of which are Soviet and 2 English.

SUBMITTED: March 4, 1958

Card 3/3

AUTHOR: Shevchik, V.N. SOV/109-4-1-28/30

TITLE: Relationship Between the Approximation of a Given Field and the Kompfner Method of Successive Approximations in the Theory of a Backward-wave Tube (O sootnoshenii mezhdu priblizheniyem zadannogo polya i metodom posledovatel'nykh priblizheniy Kompfnera v teorii lampy obratnoy volny)

PERIODICAL: Radiotekhnika i Elektronika, 1959, Vol 4, Nr 1, p 147 (USSR)

ABSTRACT: In a number of earlier works (Refs 1-4), the author described a simplified method of calculating the parameters of a backward-wave tube. This method was based on the analysis of the energy relationship obtained by approximating a given field. Here it is shown that on the basis of the author's previous analysis, it is possible to derive the basic equations of a backward-wave tube and that these coincide with the Kompfner equations which are derived by the method of successive approximations (Ref 5). Thus, it is shown that the field of the secondary wave E_2 is expressed by the last equation on p 147; the real part of

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SOV/109-4-1-28/30

Relationship Between the Approximation of a Given Field and the Kompfner Method of Successive Approximations in the Theory of a Backward-wave Tube

this equation coincides with the corresponding Kompfner equation.

There are 5 references, 4 of which are Soviet and 1 English.

SUBMITTED: April 21, 1958

Card 2/2

SOV/109-4-7-7/25

AUTHORS: Shevchik, V.N. and Lapshova, L.A.

TITLE: Kinematic Theory of the Backward-wave Tube

PERIODICAL: Radiotekhnika i elektronika, 1959, Vol 4, Nr 7, pp 1134 - 1144 (USSR)

ABSTRACT: The theory presented in the article is not new and was originally developed by O. Doehler and W. Kleen (Ref 1). However, the theory is taken a step further in that it permits the evaluation of the electron interaction power. It is assumed that in the system considered, the electromagnetic wave propagates in the positive direction of the axis X and has a phase velocity v_Φ, whose direction is inverse to that of the group velocity. The field of the wave can be written as:

$$E = E_1 e^{j\omega t + \Gamma x}$$

where $\Gamma = \gamma - j\beta$; γ is the wave constant and β is the phase constant. The electron beam moves also in

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SOV/109-4-7-7/25

Kinematic Theory of the Backward-wave Tube

the direction of the positive X and has a velocity v_o. It is assumed that the electron beam is rectilinear and narrow so that the field of the wave is constant over the cross-section of the beam; the amplitude of the wave is comparatively small, so that the electron velocities due to this field are small in comparison with v_o. The space charge effect is also neglected. The equation of motion of an electron can be written as:

$$\ddot{x} = \eta E_1 e^{j\omega t + \Gamma x} \qquad (1)$$

where η is a normalised charge of an electron. The following normalised quantities are introduced: Φ_o is the free relative transit angle, Φ is the relative transit angle while the system is perturbed; l is the length of the interaction space; V_o is the acceleration voltage, $\alpha = \omega t_1$ is the input phase of an electron;

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Kinematic Theory of the Backward-wave Tube

$\xi = E_1 l/v_o$, $\mu = \xi/2\Phi_o$, $\rho = 1 - v_o/v_\Phi$, $\delta = \omega\rho/v_o$, $\varphi_o = \omega x/v_o$. The equation of motion can now be written as Eq (2) or Eq (3). Integration of the latter gives the velocity modulation of the electrons by the wave; this is described by Eq (4). Further integration of Eq (4) gives an expression for the transit angle of the electrons:

$$\Phi = \Phi_o - \frac{\mu}{\left(j + \frac{\gamma}{\delta}\right)^2}\left[e^{\left(j+\frac{\gamma}{\delta}\right)\Phi} - j + \frac{\gamma}{\delta}\ \Phi - 1\right]e^{j\alpha} \qquad (5) .$$

This can be written approximately as Eq (6). The absolute transit angle, on the basis of Eq (6), can be expressed by Eq (7). The bunched current in the field of/the travelling wave can be evaluated from the charge-conservation law (Eq 8). If the signal is small and the condition expressed

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by Eq (9) is fulfilled, the bunched current is given by Eq (10). The interaction power of the electron beam, taken over one period, is given by Eq (11). By substituting Eq (10) in Eq (11), the interaction power is given by Eq (12). By integrating Eq (12), it is found that the real and the reactive components of the interaction power are expressed by Eqs (13) and (14), respectively. The power flowing in the delay system of the tube is expressed by Eq (21), where Γ_o and K are given by the first equations on p 1137; the parameters Z and Y in these equations represent the impedance and the parallel admittance of the delay system. On the basis of Eq (21), the real and the reactive components of the power in the delay system are given by Eqs (22) and (23), respectively. Comparison of the power components represented by Eqs (13) and (22) and (14) and (23) permit determination of γ and $\Delta\beta$; these are expressed by Eqs (25) and (27), respectively. The results calculated on the basis of Eqs (25) and (27) are plotted in Figures 1 to 8. Figures 1 and 2 show the

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Kinematic Theory of the Backward-wave Tube

amplitude and phase constants as a function of ρ for various values of the parameter C . Figures 3, 4 and 5 show the dependence of γ/β_e , ρ , $\Delta\beta/\beta_e$ on the parameter $\left(v_e/v_{\phi x} - 1\right)$ for the first and second wave components for three values of the parameter C . The amplification of the tube can be determined by considering three partial waves, each of which should satisfy certain boundary conditions at the input and the output of the tube. The conditions state that the alternating components of the current and velocity at $x = 0$ should be 0 and that the output energy should be equal to the sum of the three waves; the boundary conditions are described by Eqs (28), (29) and (30). Since the velocity and the current of the tube are described by Eqs (31) and (32), the boundary conditions can be expressed by Eqs (33), (34) and (35). A simultaneous solution of these equations leads to:

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SOV/109-4-7-7/25

Kinematic Theory of the Backward-wave Tube

$$\frac{E(l)}{E(0)} = \frac{E_{10}}{E_0} e^{(\gamma_1 - j\beta_1)l} + \frac{E_{20}}{E_o} e^{(\gamma_2 - j\beta_2)l} + \frac{E_{30}}{E_o} e^{(\gamma_3 - j\beta_3)l} \quad (36)$$

This represents a quantity inverse to the amplification of the tube. The real part of Eq (36) can be expressed by Eq (37), while the imaginary part is given by Eq (38). The condition of the self-excitation of the tube is $E(l) = 0$. This condition is fulfilled when the parameters of Eqs (37) and (38) have the values represented by Eqs (40) and (41). If it is necessary to consider the space-charge field E_2, the equations of the tube are

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in the form of Eqs (42) (Yu.A. Katsman - Ref 13 and V.N. Shevchik, V.S. Stal'makhov - Ref 14). In the case of small signals, the equations lead to Eq (43). The integration of this shows that the velocity is given by Eq (44) and the transit angle is expressed by Eq (45). The bunched current is given by Eq (46); the average electron interaction power is expressed by Eq (47) and its real and reactive components are given by Eqs (48) and (49), respectively. Therefore, the solution of the characteristic equation of the system is given by Eqs (50)-(52). There are 8 figures and 14 references, of which 5 are English, 1 German, 1 French and 7 Soviet.

SUBMITTED: February 6, 1958

S/194/62/000/006/149/232
D201/D308

9.4210

AUTHORS: Shevchik, V.N., and Demina, A.Ye.

TITLE: Theory of the plane magnetron

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 6, 1962, 14, abstract 6Zh101 (Nauchn. yezhegodnik. Saratovsk. un-t. Fiz. fak. i N.-i. in-t mekhan. i fiz. 1955. Saratov, 1960, 107-108)

TEXT: The results of evaluation of the electronic efficiency and the analysis of conditions of self-excitation of a plane magnetron are given in kinematic approximation. A relationship was obtained which describes the efficiency as a function of transmit angle in various regimes, except the critical and beyond-the-critical. [Abstracter's note: Complete translation.]

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S/194/62/000/006/145/232
D201/D308

9,2580

AUTHORS: Shevchik, V.N., and Ashavskaya, Ye.M.

TITLE: Electronic tuning of a generator with delaying field

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 6, 1962, 13, abstract 6Zh94 (Nauchn. yezhegodnik. Saratovsk. un-t. Fiz. fak. i N.-i. in-t mekhan. i fiz. 1955. Saratov. 1960, 108-109)

TEXT: The authors give the results of experimental study of the range of electronic tuning of a decimeter wave generator with delaying field. It is established that the range of electronic tuning of such a generator is comparable with the corresponding quantity for a standard reflex klystron. The advantages of the generator are its simple construction and the possibility of using industrial triodes. [Abstracter's note: Complete translation.]

VB

Card 1/1

S/194/62/000/006/144/232
D201/D308

AUTHORS: Shevchik, V.N. and Zharkov, Yu.D.

TITLE: Theory of carcinotron

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 6, 1962, 13, abstract 6 Zh 93 (Nauchn. yezhegodnik Saratovsk. un-t. Fiz. fak. i N.-i. in-t mekhan. i fiz. 1955. Saratov, 1960, 109-110)

TEXT: The results of a theoretical investigation of interaction between the electron stream and the retarding system in a backward-wave tube oscillator are given, the whole range of space harmonics being considered. The analysis of the interaction reduces to the study of cascaded electron bunching in the sequence of m HF gaps. A formula for active power of the interaction of the electron stream with m HF gaps is derived. It is emphasized that taking into account the interaction with higher space harmonics is essential especially when m is small. [Abstracter's note: Complete translation.]

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S/194/62/000/004/085/105
D271/D308

9.4230

AUTHORS: Shevchik, V. N. and Shvedov, G. N.

TITLE: Study of some characteristics of an electron-wave oscillator

PERIODICAL: Referativnyy zhurnal, Avtomatika i radioelektronika, no. 4, 1962, abstract 4zh118 (Uch. zap. Saratovsk. un-t, 1960, 69, 77-89)

TEXT: Results are reported of an experimental study of retarding-field electron-wave oscillator (RZhFiz., 1961, 3zh317). The dependence of the oscillation frequency on the current density, with fixed electrode voltages, was investigated. No substantial frequency variations were found. The influence of the grid penetration factor on the oscillator characteristics and the relation between the frequency and retarding field length were studied. Frequency characteristics are given of two-cathode tubes with retarding field. Results are shown of the calculation of interaction of opposite electron beams by the method of postulated field. [Abstracter's note: Complete translation.]

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S/194/62/000/004/086/105
D271/D308

9,4210

AUTHORS: Shevchik, V. N. and Stal'makhov, V. S.

TITLE: On the theory of magnetrons

PERIODICAL: Referativnyy zhurnal, Avtomatika i radioelektronika, no. 4, 1962, abstract 4zh122 (Uch. zap. Saratovsk. un-t, 1960, 69, 91-94)

TEXT: Two methods used for the analysis of split-anode magnetron operation are compared: "method of travelling wave" and "method of cascade bunching". It is noted that the first method describes adequately the hyper-critical operation of the magnetron ($H = 2 \div 3\ H_{crit}$), whereas the second method gives a good approximation of the near-critical operation. By means of the first method, the authors consider the operational mechanism of the magnetron in near-critical conditions, from the point of view of the theory of travelling waves. A characteristic equation is obtained for the oscillations (dependence of the wavelength on the parameters, mode of operation and the geometry of the magnetron); this equation

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On the theory of magnetrons S/194/62/000/004/086/105
D271/D308

coincides with the corresponding formula of Postumus and the relation of Slater and Hartree, with an accuracy extending to the coefficient. Experimental values of this coefficient approximately agree with those obtained analytically. It is pointed out that the discussed method yields, in a simpler manner, the principal conclusions of the split-anode magnetron theory based on the concept of cascade bunching of electrons. /Abstracter's note: Complete translation./

Card 2/2

69426

S/141/60/003/01/020/020
E032/E514

9.9000

AUTHORS: Shevchik, V. N. and Pokrovskiy, L. D.

TITLE: Energy Exchange in the Discrete Interaction of Electrons with a Travelling Electromagnetic Wave

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1960, Vol 3, Nr 1, pp 155-158 (USSR)

ABSTRACT: The analysis of the energy exchange between electrons and electromagnetic waves propagated in a periodic structure can be carried out by considering the discrete interaction of the electron current with a succession of high frequency fields separated by field-free gaps (Ref 1). In a previous paper (Ref 1) an analysis was given of the cascade interaction between electrons and a constant amplitude wave, assuming that the transit angles through the interaction regions are small. The present paper extends this analysis to the case where the ratio of the length of the high frequency regions to the length of the field-free gaps is arbitrary. The following simplifications are made:
1) Standing electromagnetic fields are set up in the

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E032/E514

Energy Exchange in the Discrete Interaction of Electrons with a Travelling Electromagnetic Wave

interaction regions (outside the field-free gaps) and the amplitude is the same for all these standing waves;
2) the amplitudes of the high frequency fields in the gaps are small;
3) in assuming the effect of the high frequency field on the electron current the effect of the electron current on the field of the system is expressed in terms of the energy interaction only; the change in the distribution of the electromagnetic field in the system as a result of this interaction is not considered (the "given field" approximation).
Integration of the equation of motion of the electron under the above assumptions leads to Eq (1) which gives the velocity of the electron at a general point x in the k-th gap. The transit angle in the region between the (k-1)-th and the k-th high frequency gaps is given by Eq (3). The total electron transit angle for the

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82454

9.4220 S/141/60/003/03/009/014
E192/E382

AUTHORS: Shevchik, V.N. and Shvedov, G.N.

TITLE: An Electron-Wave Oscillator with a Retarding Field

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1960, Vol. 3, No. 3, pp 432 - 441

TEXT: Several years ago it was observed at the Electronics Laboratory of the Saratov University that a reflex klystron could generate oscillations of the decimetre range in the absence of the resonator. The investigation of these oscillations is of considerable theoretical interest since it may help to explain the nature of the electron oscillations in systems with a retarding field and in other ultrahigh-frequency oscillators having a large electronic tuning bandwidth. First, in order to explain the oscillations observed it was checked whether they were not due to some unknown parasitic oscillatory circuits. For this purpose, an external resonant circuit, having a low quality factor, was connected to the klystron (Fig. 7) and the dependence of power and oscillation frequency on the voltage at the grids was studied (Fig. 1). It was found that the oscillations with such external resonant circuits were impossible. It appears that the most logical

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S/141/60/003/03/009/014
E192/E382

An Electron-wave Oscillator with a Retarding Field

and consistent explanation of the oscillations observed is obtained if it is assumed that they are due to the oscillatory properties of the electron beam itself. These properties are due to the Coulomb repulsion forces between electrons. By considering the Coulomb interaction, the propagation of a perturbance in an electron beam can take the form of density, velocity and electric-field waves. In general, the generation of the oscillations in a tube with a retarding field can be represented by the following model. A closed electron beam can be regarded as a "Sui generis" electron resonator since there can exist only specified frequencies which satisfy the condition of the space-charge wave. In order that the oscillations be maintained without attenuation, it is necessary to secure an electron-wave interaction with an energy transfer into the high-frequency field of the space charge. In this way, the electron resonator becomes an electron-wave oscillator. By applying the above general system to the oscillations observed in klystrons, it is necessary to bear in mind that an exact analysis of a system with a retarding field is as yet impossible. It is therefore advisable

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An Electron-wave Oscillator with a Retarding Field

to split the problem into two parts. First, an idealised system of interaction of the electron beams is considered in order to explain the possibility of the energy exchange between an electron beam and the high-frequency field of the space charge. The process is illustrated in Fig. 2. The graph represents the dependence of the interaction power of the electron beams on the transit angle φ_o of the electron beam in the interaction space;

$\varphi_o = \omega z/v_o$, where ω is the generated frequency, z is the length of the interaction space and v_o is the velocity of the electrons. The negative power in the graph represents the interaction power corresponding to the transfer of the energy into the high-frequency field. From Fig. 2, it is seen that this is possible over a wide range of the transit angle φ_o . The second part of the problem consists of defining the frequency characteristics of the oscillator. The process will be maintained in a closed electron beam at a frequency such that an integral number of wavelengths appears over the closed path. However, since the phase velocity of the space-

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An Electron-wave Oscillator with a Retarding Field

charge waves differs very slightly from the electron velocity, this condition means that an integer number n of the oscillations is generated during the transit time of an electron between cathode-reflector-cathode. Consequently, the generated frequency is given by:

$$f = n \frac{1.48 \cdot 10^5 \sqrt{V_g}}{d_1 + d_2/2 + d_3/(1 - V_r/V_g)} \qquad (1)$$

where V_g is the voltage at the grids,
V_r is the voltage at the reflector,
d_1 is the length of the acceleration space,
d_2 is the length of the drift space and
d_3 is the length of the retardation space.

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E192/E382

An Electron-wave Oscillator with a Retarding Field

A number of experiments were carried out to determine the influence of d_1, d_2 and d_3 on the magnitude of the generated frequency. The effect of d_2 is illustrated in Fig. 3a, while f as a function of d_3 is shown in Fig. 3б. The points in Fig. 3a represent the experimental values, while the sloping line was calculated on the basis of Eq. (1). It is seen that no satisfactory agreement between the calculated and the experimental results is obtained in Fig. 3б. The dependence of frequency on V_g for two values of the reflector voltage is illustrated in Figs. 4. Fig. 5 shows the dependence of f on V_r. Fig. 6 shows the dependence of f on the power P of the generator on the distance ℓ between the plungers of the three tuning lines from the axis of the klystron. The above experimental data indicate that the representation of an oscillator with a retarding field by means of a closed electron beam is quite feasible. The above concept should be regarded as an attempt to explain the electron oscillations in a system with a retarding field which is in general agreement with the available experimental data

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S/141/60/003/03/009/014
E192/E382

An Electron-wave Oscillator with a Retarding Field

and modern theories. It is not, however, a complete theory. There are 7 figures and 22 references: 12 Soviet, 8 English, 1 French and 1 German.

ASSOCIATION: Saratovskiy gosudarstvennyy universitet (Saratov State University)

SUBMITTED: December 24, 1959

Card 6/6

69911
S/109/60/005/04/027/028
E140/E435

9.4220

AUTHORS: Shevchik, V.N. and Sheyedov, G.N.

TITLE: On the Effect of the External Circuits on the Operation of an Electron-Wave Oscillator

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol 5, Nr 4, pp 698-700 (USSR)

ABSTRACT: It is shown experimentally that an electron-wave oscillation mechanism previously reported (Ref 1,2) exists in reflex klystrons. There are 4 figures and 8 references, 3 of which are Soviet and 5 English.

SUBMITTED: July 2, 1959

Card 1/1

S/109/60/005/06/019/021
E140/E163

AUTHORS: Shevchik, V.N., and Pokrovskiy, L.D.

TITLE: Estimate of the Role of Space Charge in Kompfner's BWT-Theory

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol 5, Nr 6, pp 1008-1010 (USSR)

ABSTRACT: Kompfner's method of successive approximations is distinguished by greater simplicity than other theories. However, he neglects the electron beam space charge. Correction for this is analysed in the present paper and it is shown that the results agree well with those obtained by Heffner using self-matched solutions. There are 2 figures and 6 references, of which 2 are Soviet and 4 English.

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SUBMITTED: November 16, 1959

S/109/60/005/010/024/031
E073/E482

9,4231

AUTHORS: Shevchik, V.N. and Trubetskov, D.I.

TITLE: Contribution to the Theory of Backward Wave Tubes With a Periodically Focused Electron Beam

PERIODICAL: Radiotekhhnika i elektronika, 1960, Vol.5, No.10, pp.1734-1736

TEXT: In backward wave tubes, which are based on utilizing alternating electrostatic focusing of the electron beam, the free movement of the electrons is nonuniform, as a result of which the conditions of synchronism between the electron beam and the electromagnetic wave is periodically disturbed. Since with the exception of qualitative statements made by Yu.B.Samorodov and I.P.Ni (Ref.3) such systems have not been analysed; an attempt is made to evolve a linear theory of backward wave tubes with alternating electrostatic focusing of the electron beam. Analysis of the processes which take place in the system is carried out by approximating the given field, since this simplified method proved useful in earlier work on this theory (Ref.1). The equation of motion of the electrons in the system under investigation can be written in the following simplified manner:

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S/109/60/005/012/030/035
E192/E582

9,4231

AUTHORS: Shevchik, V.N. and Zharkov, Yu. D.

TITLE: The Effect of Reflections on the Operation of a Backward Wave Tube

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol.5, No.12, pp. 2059-2060

TEXT: The influence of the reflections from the terminals of the delay system of the tube on its operation is analysed by the field method (Refs.1-4). It is assumed that the oscillation condition for a backward wave tube can be written as

$$\rho G = 1, \tag{1}$$

where

$$\rho = r_K r_\Pi e^{j(\psi_K + \psi_\Pi + 2\beta L)} = re^{j\psi} ;$$

where r_K, r_Π, ψ_K, ψ_Π are the moduli and phases of the reflection coefficients for the collector and cathode terminals of the tube, respectively; L is the length of the delay system, β is the propagation constant and G is the gain of the tube. The gain of

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The Effect of Reflections on the Operation of a Backward Wave Tube

the tube can be expressed by $G = E_1/(E_1 + E_2)$, where E_1 is the amplitude of the field at the output of the tube and E_2 is the amplitude of the "secondary" field. Equations for E_2 and 1/G are derived and on the basis of Eq.(1) it is shown that the oscillation conditions for the tube can be expressed as

$$\Phi_o = 2 \text{ arc tg } \frac{r \cos \psi - 1}{r \sin \psi} \quad (2)$$

$$I_{CT} = I_{CTO} \sqrt{1 - 2r \cos \psi + r^2} \quad (3)$$

where I_{CTO} is the starting current which does not take into account the reflections. Eqs. (2) and (3) coincide with similar formulae obtained by G. Bolz (Ref.7). There are 8 references, 5 Soviet and 3 non-Soviet.

SUBMITTED: June 25, 1960

Card 2/2

SHEVCHIK, V.N.; KURAYEV, A.A.

General dispersion equation of a traveling-wave tube with a periodical delay structure. Radiotekh. i elektron. 6 no.9:1519-1532 S '61. (MIRA 14:8)

(Traveling-wave tubes)

30295
S/109/61/006/011/010/021
D266/D304

9,4231

AUTHORS: Shevchik, V.N. and Sinitsyn, N.I.

TITLE: The effect of velocity spread on the operation of backward wave oscillators

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 11, 1961, 1881 - 1887

TEXT: The purpose of the paper is to study the effect of velocity spread on the output power and starting current of backward wave oscillators. Following Lopukhin's method (Ref. 10: GITTL, 1953) the problem is solved by successive approximation. The electric field is first determined in the absence of the electron flow and then the interaction of the electrons with this "cold" field is taken into account. Having obtained the a.c. current the author proceeds to calculate the "secondary" field caused by the presence of the electrons. It is assumed throughout the paper that the a.c. quantities are always considerably smaller than the d.c. quantities, i.e. small signal considerations apply. The author starts the mathematical investigation by writing up the linearized Liouville

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equation in the absence of d.c. electric fields and neglecting collisions. The d.c. distribution function is taken in the following form:

$$f_0(v) = \frac{N_0}{\Delta v}\left\{\int\limits_{-\infty}^{v} \delta[v - (v_0 - \frac{\Delta v}{2})]dv - \int\limits_{-\infty}^{v} \delta[v_0 + \frac{\Delta v}{2})]dv\right\}, \quad (5)$$

where δ - Dirac function, N_0 and v_0 - average values of d.c. number density and velocity respectively, $\Delta v = 2v_0\varepsilon$ - d.c. velocity spread, and $\varepsilon \ll 1$. Using this form of $f_0(v)$ the a.c. current is obtained with the aid of a formula taken from (Ref. 10: Op.cit.) and a further general formula (losses in the circuit included) is derived for the output power. In the case of zero losses some numerical data are given. In Fig. 2 normalized power is plotted against the parameter $\Phi_0 = (1 - v_0/v_{ph})\varphi_0$ where v_{ph} is the phase velocity of the circuit wave, $\varphi_0 = \omega l/v_0$; l - the length of the interaction region; ω - angular frequency (in all the numerical calculations

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$\varphi_0 = 20\pi$ is assumed). It is concluded that in the presence of velocity spread, $\varepsilon > 0$, the available output power decreases. The validity of this conclusion is not restricted to backward wave devices and can be applied for forward waves as well. The increase in starting current is shown in Fig. 3, where the normalized starting current (related to the case of no velocity spread) is plotted against ε. The calculations were carried out by neglecting terms higher than ε^2 which gives sufficient accuracy up to $\varepsilon = 0.04$ as confirmed by higher order approximations for the special case $I = 0$. The author states that the results of his calculations resolve the discrepancy between single-velocity theory and experiments (found in BWO's working at low voltages). The measured starting current was 24 mA (twice the value given by single-velocity theory) and the author's theory gives 21.2 mA. It is concluded that for high frequency tubes the effect of velocity spread is negligible. There are 3 figures and 11 references: 6 Soviet-bloc and 5 non-Soviet-bloc. The references to the English-language publications read as follows: W.L. Beaver, IRE Convention Record, 1956, 4, 3, 35; N.C. Chang, Electronic Components Conf. Proc., Los Angeles, California

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S/109/61/006/011/010/021
D266/D304

The effect of velocity spread on ...

1955, p. 47; D.A. Watkins, N. Rynn, Effect of velocity distribution of travelling-wave tube gain, J. Appl. Phys, 25, 11, 1375; H. Johnson, Proc. IRE, 1955, 43, 684.

SUBMITTED: March 29, 1961

Fig. 2.

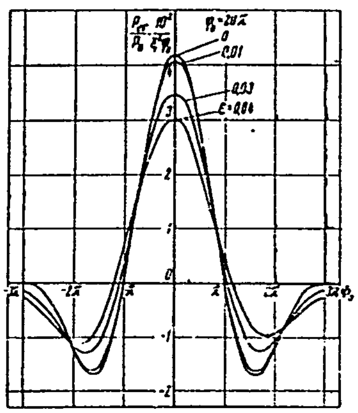

Fig. 3.

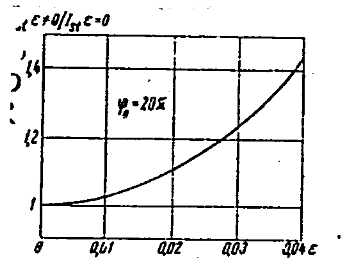

Рис. 3

Card 4/4

SHEVCHIK, V.N.; SHVEDOV, G.N.; SOBOLEVA, A.V.; Prinimala uchastiye TRUBETSKOV, D.I., aspirant; VINNIKOVA, I.A., red.; ZENIN, V.V., tekhn. red.

[Oscillatory and wave effects in electron currents at superhigh frequencies]Volnovye i kolebatel'nye iavleniia v elektronnykh potokakh na sverkhvysokikh chastotakh. Saratov, Izd-vo Saratovskogo univ., 1962. 334 p. (MIRA 15:10)
(Microwaves) (Electromagnetic waves) (Microwave tubes)

39698
S/142/62/005/002/001/019
E192/E382

9,3130

AUTHORS: Shevchik, V.N. and Trubetskov, D.I.

TITLE: Discrete interaction of two electron streams

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiotekhnika, v. 5, no. 2, 1962, 143 - 157

TEXT: A system consisting of two electron streams which are velocity-modulated at the input and separated by a metallic boundary furnished with apertures is considered. Analysis of the concrete interaction of the beams is based on the methods used by Shevchik and Zharkov (Radiotekhnika i elektronika, v.2, no.2, 1957, 237) and Shevchik and Mayofis (Izv. vuzov. SSSR - Radiotekhnika, v. 2, no. 3, 1959, 367) so that the influence of nonsynchronous harmonics can be taken into account. The electron streams have different steady-state velocities v_{01} and v_{02} and $v_{01} > v_{02}$. The streams interact with each other only during their passage above the same slot of the metal boundary, so that the field of the space charge of the first (second) stream through which passes the second (first) stream

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changes periodically along the coordinate Z with a period ℓ. The interaction of the beams in this system can therefore be regarded as discrete (Fig. 2). The change of the space-charge field from slot to slot is described by the factor $e^{-i\beta z}$, where β is an unknown propagation constant. The potential at the k-th slot, acting on the second stream, is written in the form:

$$M_2 \Delta V_k^{(2)} = M_2 \Delta V_1 e^{-j(k-1)\beta\ell + j\omega t_k} \tag{1}$$

where $\omega t_k = \omega t_1 + \sum_{m=1}^{k-1} \Theta_m^{(2)}$ is the input phase of the electrons in the k-th gap, ωt_1 is the initial input phase of the electrons, $\Theta_m^{(2)} = \omega\ell/v_m^{(2)}$ is the perturbed transit angle of the second beam during the m-th period and ΔV_1 is the potential amplitude of the first slot which corresponds to the amplitude of the

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external modulating potential. The quantity M in Eq. (1) is referred to as the "modulation efficiency parameter":

$$M_{1(2)} = \frac{\sin \frac{\omega d}{2 v_{01(2)}}}{\frac{\omega d}{2 v_{01(2)}}}$$

where $\omega d/v_{01(2)}$ is the non-perturbed transit angle of the electrons of the first (second) stream. The scattering equation for a simple case of two slalom-focused electron beams is derived.
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With regard to the interaction of the spatial harmonics it is found that the whole operating range of the system can be divided into a set of interaction bands, where the signal can increase and stability bands where the increase of the signal is impossible. The case of two beams moving in opposite directions with identical velocities is also considered and it is found that the discrete interaction of two such beams leads to the appearance of the interaction bands and stability bands so that this case differs from that of the continuous interaction. While the propagation constants of the system were determined from the scattering equations, their amplitudes are determined from the initial conditions at the input of the system. Also, by considering the boundary conditions it is possible to derive general formulae for the amplitudes of the partial waves and for the gain of the system. The conditions of oscillations for two electron beams propagating in opposite directions are also determined.
There are 6 figures.

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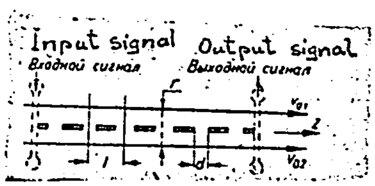
E192/E382

ASSOCIATION: Kafedra elektroniki Saratovskogo gos. universiteta im. N.G. Chernyshevskogo (Department of Electronics of Saratov State University im. N.G. Chernyshevskiy)

SUBMITTED: June 30, 1961

Fig. 2:



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45033

S/109/63/008/001/013/025
D266/D308

94231

AUTHORS: Shevchik, V. N. and Sinitsyn, N. I.

TITLE: Effect of reflections on the operation of backward wave tubes

PERIODICAL: Radiotekhnika i elektronika, v. 8, no. 1, 1963, 99-107

TEXT: The purpose of the paper is to investigate theoretically the starting current and efficiency of backward wave oscillators in the presence of space charge and finite reflections. If a part of the circuit wave is reflected then the condition of oscillation is no longer infinite gain but instead the product of gain and reflection coefficient must be unity. The gain is calculated on the basis of two earlier works by Shevchik (Osnovy elektroniki SVCh (Fundamentals of microwave electronics), Izd. Sovetskoye radio, 1959;*Radiotekhnika i elektronika, 1960, v. 5, no. 12, 2059). The solution is obtained by successive approximations where, in the zero order approximation, the amplitude of the circuit wave is taken as constant and its phase varying as exp $j(\omega t - \beta z)$. The gain is calculated by

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Effect of reflections ... S/109/63/008/001/013/025 D266/D308

a second order approximation. Applying the condition of oscillation, the starting current is

$$I_{st} = I_{st0}\,(1 - r\cos\psi)\,\frac{fa_0}{fa} \qquad (8)$$

where I_{st0} - value of starting current in the absence of reflections, r - absolute value of the reflection coefficient, ψ- phase of the reflection coefficient, f_a - a relatively simple rational trigonometric function depending on the parameters of the tube, f_{a_0} - the f_a function in the absence of reflections. Neglecting space charge it is found that if $\psi = k\pi$ (k - integer), the effect is similar to that of positive or negative feedback, namely the starting current increases or decreases but the oscillation frequency remains

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constant. If $\psi = (2k + 1)\frac{\pi}{2}$ there is a change in frequency. This is valid only for small values of r because for large reflections the interaction of the electron beam with the reflected wave cannot be neglected. The effect of space charge is small

$$\frac{\omega_p l}{v_o} \leqslant 2.15$$

(ω_p - electron plasma frequency, l - length of the interaction region, v_o - d.c. velocity of the electrons). Larger values of space charge lead to appreciable differences, for example, the appearance of discontinuities in the frequency-beam voltage curve. This conclusion is borne out by experiments as well. The effects of circuit losses and current interception are treated qualitatively. Efficiency for the zero space charge case is determined by using a method described by R. W. Grow and D. A. Watkins (Proc. IRE, 1955, v. 32, no. 7, 848). There are 7 figures.

SUBMITTED: February 16, 1962

L 10374-63
ACCESSION NR: AP3000326 S/0142/63/006/002/0117/0126

44

AUTHOR: Zyuryukin, Yu. A.; Trubetskov, D. I.; Shevchik, V. N.

TITLE: Effect of cyclotron resonance of the operation of superhigh-frequency magnetron-type beam tubes

SOURCE: Izv. VUZ: Radiotekhnika, v. 6, no. 2, 1963, 117-126

TOPIC TAGS: cyclotron resonance, M-type TW tube, M-type backward-wave tube, superhigh-frequency tubes

ABSTRACT: By using the method of successive approximations, the problem is solved of the interaction between a traveling electromagnetic wave and an electron stream that flows in the crossed electrostatic and magnetostatic fields; an allowance is made for cyclotron rotations of electrons. It is pointed out that, near the cyclotron resonance, the electromagnetic wave can be absorbed and amplified, depending on the structure of the high-frequency field that the cyclotron resonance engenders. Operating conditions in the M-type TW tube and backward wave tube are examined; limits of applicability of the theoretical

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ACCESSION NR: AP3000326

analysis of such tubes based on the adiabatic approximation are found. Similar results are obtained with the method of dispersion equation. Orig. art. has: 25 equations and 5 figures.

ASSOCIATION: Saratov gos. universitet im. N. G. Cherny*shevskogo (Saratov State University)

SUBMITTED: 09July62 DATE ACQ: 13Jun63 ENCL: 00

SUB CODE: CO NR REF SOV: 002 OTHER: 002

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L 33574-66 EWT(1) IJP(c) AT

ACC NR: AR6016250 SOURCE CODE: UR/0058/65/000/011/H026/H026

61

B

AUTHOR: Zyuryukin, Yu. A.; Shevchik, V. N.

TITLE: Concerning electron waves in homogeneous beams

SOURCE: Ref. zh. Fizika, Abs. 11Zh179

REF SOURCE: Sb. Vopr. elektron. sverkhvysok. chastot. Vyp. I. Saratov, Saratovsk. un-t, 1964, 17-26

TOPIC TAGS: electron beam, electron motion, waveguide propagation, traveling wave interaction, electromagnetic field

ABSTRACT: It is proved that when the problem is rigorously solved the motion of an electron beam in fields of homogeneous transmission lines can be described with the aid of an infinite number of electronic waves. Each of the waves corresponds to a definite distribution function of the variable current density over the beam cross section. The aggregate of the distribution functions forms an orthogonal system on the cross section of the transmission line. The propagation constants of the waves are determined either from a dispersion equation of infinite degree, or from an infinite set of dispersion equations of fourth degree. A general solution is obtained for the coefficient of reduction of the plasma frequency in a screened electron beam of finite dimensions. Questions involved in determining the amplitude of the infinite set of electronic waves are discussed. The proposed analysis pertains both to the interaction between the electron beams and slow waves and to the behavior of screened electron beams. A. Roshal'. [Translation of abstract]

SUB CODE: 20, 09/ PP

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L 04220-67 EWT(1) IJP(c) AT

ACC NR: AR6015857 SOURCE CODE: UR/0275/65/000/012/A004/A004

71
70
B

AUTHOR: Zyuryukin, Yu. A.; Shevchik, V. N.

TITLE: On the problem of electron waves in homogeneous flow

SOURCE: Ref. zh. Elektronika i yeye primeneniye, Abs. 12A18

REF SOURCE: Sb. Vopr. elektron. sverkhvysok. chastot. Vyp. 1. Saratov, Saratovsk. un-t, 1964, 17-26

TOPIC TAGS: traveling wave tube, homogeneous flow, traveling wave, electron tube, Coulomb repulsion force, electron flux

ABSTRACT: An exact solution is found for the problem of estimating the infinite sum of unlimited waves (W) excited in a TWT (traveling-wave tube) circuit or transit tubes by a modulated electron flux (EF) by means of the depression factor of Coulomb repulsion forces in the EF, and the problem of considering the transverse density distribution of the HF current in an EF of finite transverse dimensions. From the solution of the electronics equation, an expansion of the field into a Fourier series according to a system (S) of orthogonal functions is obtained, at any point in the reaction space (regardless of the presence of electrons there), by means of the Laplace transformation. The expansion obtained forms an infinite S of integral equations

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relative to an infinite set of unknown functions. Assuming, moreover, the processes in the TWT are wave processes, the characteristic equation is compiled for an S of differential equations corresponding to an S of integral equations. In this case it is observed that every two "cold waves" in the line are peeled off, in general, into an infinite number of electron waves, whose propagation constants may be found from the uncalculated set of fourth-degree dispersion equations. By means of this property of the system, a general expression is sought for the reduction factor of the plasma frequency, with screening out of the EF of finite dimensions; problems in the determination of the amplitudes of an entire infinite quantity of electron waves are discussed briefly. [Translation of abstract] Bibliography of 9 titles. D. Ya.

SUB CODE: 20

ACCESSION NR: AP4040746 S/0142/64/007/002/0131/0138

AUTHORS: Budnikova, N. P.; Sinitsy*n, N. I.; Shevchik, V. N.

TITLE: Effect of beam current decrease along a slow wave system on the operation of backward and traveling wave tubes

SOURCE: IVUZ. Radiotekhnika, v. 7, no. 2, 1964, 131-138

TOPIC TAGS: backward wave tube, traveling wave tube, slow wave system, electron beam, electron loss

ABSTRACT: In view of the facts that earlier analyses neglected the decrease in the dc component of the beam current in a traveling or backward wave tube, a decrease which always occurs in real tubes, the authors develop a linear theory in which the electron loss in interaction space is taken into account. Since the character of the beam depends essentially on the type of slow-wave structure employed, estimates are made for both continuous and decrease reduction in the

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KURAYEV, A.A.; ROMANOV, B.N.; SHEVCHIK, V.N.

Start conditions in E-type generators. Radiotekh. i elektron. 9 no.6:983-993 Je '64. (MIRA 17:7)

KURAYEV, A.A.; SHEVCHIK, V.N.

Special feature of the interaction of a relativistic helical flow of electrons with an electromagnetic wave. Radiotekh. i elektron. 9 no.6:1083-1086 Je '64. (MIRA 17:7)

SHEVCHISHIN, I.I. [Shevchyshyn, I.I.]

Concerning IU.S. Lebedev's article "New data on the relative age of ultrabasic rocks in the southern part of the Ukrainian Crystalline Shield." Geol. zhur. 22 no.3:104-107 '62. (MIRA 15:7)

1. Trest "Kiivgeologiya".

(Dnieper Valley--Ultrabasite)
(Geological time)
(Lebedev, IU.S.)

SHEVCHUK, ~~A.~~

Semiconductor photorelays. NTO 3 no.4:58 Ap '61. (MIRA 14:3)

1. Nachal'nik nauchno-issledovatel'skogo otdela Proyektno-konstruktorskogo instituta avtomatizatsii proizvodstvennykh protsessov v promyshlennosti, g. Rustavi.
(Electric relays)

DEMKIV, O.T.; SHEVCHUK, A.I.

Natural radioactivity of some cap fungi of the Cherno Gory.
Ukr. bot. zhur. 20 no.3:97-101 '63. (MIRA 17:9)

1. L'vovskiy nauchno-prirodovedcheskiy muzey AN UkrSSR.

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001549210018-0"

SHEVCHUK, A.K., inzhener.

Precise method of measuring the number of revolutions on blooming mill stands. Stal' 16 no.5:472 My '56. (MLRA 9:8)

1. Zakavkazskiy metallurgicheskiy zavod.
(Rolling mills--Measurement) (Pipe, Steel)

SHEVCHUK, Amvrosiy Mikhaylovich; VITVITSKIY, M. [Vitvits'kyi, M.] red.; NEDOVIZ, S., tekhred.

[For 200 and 1,000] Za 200 i 1000. L'viv, Knyzhkovo-zhurnal'ne vyd-vo, 1959. 30 p. (MIRA 13:1)
(Glinyany District--Agriculture)

VAN'KEVICH, V.P.; YEVSTAF'YEVA, R.G.; MONTITSKIY, R.I.; SUKHANOVA, Ye.Yu.; SHEVCHUK, A.S.; ISHKOVA, A.K., redaktor.

[Foodstuff storage by trade organizations] Khranenie prodovol'stvennykh tovarov i torgovoi seti. Moskva, Gos. torgovoe izd-vo, 1953. 175 p. (MLRA 7:4)

1. Moscow. Nauchno-issledovatel'skiy institut torgovli i obshchestvennogo pitaniya. (Food--Storage)

SHEVCHUK, A.S.; GOYKHMAN, F.V. [Hoikhman, F.V.]

Canned vegetables and fruit. Khar.prom. no.4:34-37 O-D '62. (MIRA 16:1)

(Vegetables, Canned) (Fruit, Canned)

SHTEYNBERG, R.V.; SHEVCHUK, A.S.; TROSTINSKAYA, L.O. [Trostyns'ka, L.O.]

Simplified method for the preparation of bone broth. Kharch.prom. no.4: 56-58 O-D '63. (MIRA 17:1)

GOYKHMAN, F.V.; SHEVCHUK, A.S.

Canned food for children over 1,5 years old. Kons. i ov.prom. 18 no.10:7-10 O '63. (MIRA 16:11)

1. Ukrainskiy nauchno-issledovatel'skiy institut konservnoy promyshlennosti.

AUTHORS: Shevchuk, A., Gorelik, V. SOV-2-58-8-4/12

TITLE: Some Problems on Preparing the Reappraisal of Basic Funds (Nekotoryye voprosy podgotovki k pereotsenke osnovnykh fondov)

PERIODICAL: Vestnik statistiki, 1958, Nr 8, pp 30 - 39 (USSR)

ABSTRACT: The author divides the basic funds, which represent the most important part of the USSR national wealth, into productive and unproductive capital. During the period of the 5-year plans the basic funds of the national economy increased considerably. During WW II the basic funds were largely destroyed in the occupied districts but even then the process of creating new basic funds did not cease. The post-war years were characterized by an exceptionally turbulent growth of these basic funds. For a proper planning of reproduction, further growth and qualitative improvement of basic funds, especially the productive ones, a well organized inventory is of great significance. It should give an exact idea of the size, composition, technical level and real condition of the assets. The organization of stock-taking of basic funds is established by

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regulations covering bookkeeping, capital investments registration and the bringing into operation of basic funds, their classification, etc. In the enterprise balances, basic funds are specified at greatly varying prices depending on the year of their manufacture or purchase and methods of construction. This greatly impedes the registration and planning of reproduction of basic funds on an expanded scale. The reappraisal of the national economy's funds is a major and difficult operation. Several difficult methodological problems (methods of establishing the restoration value, amortisation, etc. must be solved. The participation of not only financial workers, bookkeepers and statisticians, but also of engineers and economists is needed. Thorough preparatory work and active cooperation on the part of enterprise managers, sovnarkhoz and ministry leaders is required. The author expresses his opinion on the method to be used. He lists examples of wrong appraisals which have taken place at the Moskovskiy zavod zhelezobetonnykh izdeliy Nr 1 Glavmoszhelezobetona (Moscow Plant of Ferro-Concrete Items Nr 1, Glavmoszhelezobeton), the Orlovskiy myasoptitsekombinat (Orel Meat and Poultry Combine), Leningradskiy farforovyy zavod imeni Lomonosova (Leningrad Porcelain Factory imeni Lomonosov), Dmitrovskiy maslosyrozavod (Dmitrov Meat and Cheese Plant) and the Moskovskaya avtobaza Nr 1 (Moscow Automobile Depot Nr 1). He then gives advice for obtaining missing vouchers, conducting a proper inventory and introducing strict discipline. There are reproductions of 2 inventory forms.

KOZLOV, T.I., prof., doktor ekon.nauk, otv.red.; BREGEL', E.Ya., prof., doktor ekon.nauk, red.; BUKH, Ye.M., dotsent, kand.ekon.nauk, red.; ZHEBRAK, M.Kh., prof., doktor ekon.nauk, red.; ISAKOV, V.I., dotsent, kand.ekon.nauk, red.; FREYMUND, Ye.N., dotsent, kand. ekon.nauk, red.; SHEVCHUK, A.V., kand.ekon.nauk, red.; SHIFMAN, A.G., dotsent, kand.ekon.nauk, red.; SHCHAPINA, T.A., dotsent, kand.ekon.nauk, red.; USTIYANTS, V.A., red.; MELENT'YEV, A.M., tekhn.red.

[Problems in statistics and accounting; a collection of articles on machine accounting] Voprosy statistiki i ucheta; sbornik statei po mekhanizatsii ucheta. Moskva, Gos.stat.izd-vo. No.2. 1959. 350 p. (MIRA 13:6)

1. Moscow. Ekonomiko-statisticheskiy institut.
(Machine accounting)